

Fermilab

ELECTRON NEUTRINO BEAM

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The Sign Selected Bare Target¹ (SSBT) train can easily be modified for an electron neutrino beam². Figures 1(a) and (b) give schematic layouts of the two arrangements. A modification required for the electron beam is a new beam dump further downstream of the second bending magnet. It might preclude the present beam switching operation between the N7 Beam Line and the N2 manhole target beam. The present beam dump for the SSBT and the second bending magnet can remotely be positioned to either beam.

Figure 2 shows a calculated electron neutrino or anti-neutrino flux from the $K_L^0 \rightarrow \pi^- e^+ \nu_e$ (or $\pi^+ e^- \bar{\nu}_e$) decay by a Monte Carlo program. The incident proton energy is 400 GeV. The K_L^0 cross section is assumed to be the average K^+ and K^- cross sections. Stefanski-White parameterization³ was used. The muon neutrino background from the π^+ and K^+ decays is also shown. The muon anti-neutrino background from the π^- and K^- decays is substantially smaller than the muon neutrino background. Also shown are the anti-neutrino fluxes for the SSBT and the Triplet Train⁴ and the neutrino flux for the Triplet Train. The fluxes for the Triplet Train were computed by the NUADA program⁵. The two anti-neutrino flux curves for the SSBT were computed by the Monte Carlo program and the NUADA program for

comparison. The muon neutrino or anti-neutrino flux from the $K_L^0 \rightarrow \pi^- \mu^+ \nu_\mu$ (or $\pi^+ \mu^- \bar{\nu}_\mu$) is 70% of the electron neutrino or anti-neutrino flux from the K_L^0 decay. The muon neutrino or anti-neutrino backgrounds from pion decays of the $K_S^0 \rightarrow \pi^+ \pi^-$ are estimated to be relatively small in the present arrangement⁶.

One or two magnets can be added to reduce the muon backgrounds originated from the other sources than the K_L^0 decay. Other types of magnets might be needed for a cleaner beam and for a reliable and clean beam dump.

Computed electron neutrino fluxes for the present electron neutrino beams are shown in Figure 3 for the incident proton energies of 400, 500 and 1000 GeV. Although at the higher energies longer and high field magnets are required in order to suppress the muon neutrino background from the π^+ and K^+ decays and to achieve reliable beam dump, it seems to be a trivial modification to maintain a similar angular acceptance as the present beam.

REFERENCES

1. R. Stefanski and H. White, Jr., TM626A, 1976.
2. Recent studies about electron neutrino beams are discussed by C. Baltay, et al, in the 1976 Summer Study (Vol. 2, p. 43).
3. R. Stefanski and H. White, Jr., FN292, 1976.
4. A. Skuja, R. Stefanski and A. Windelborn, TM469.
5. D. Carey and V. A. White, Fermilab Internal Report, NUADA, June, 1975.
6. B. Roe, private communication.

FIGURE CAPTIONS

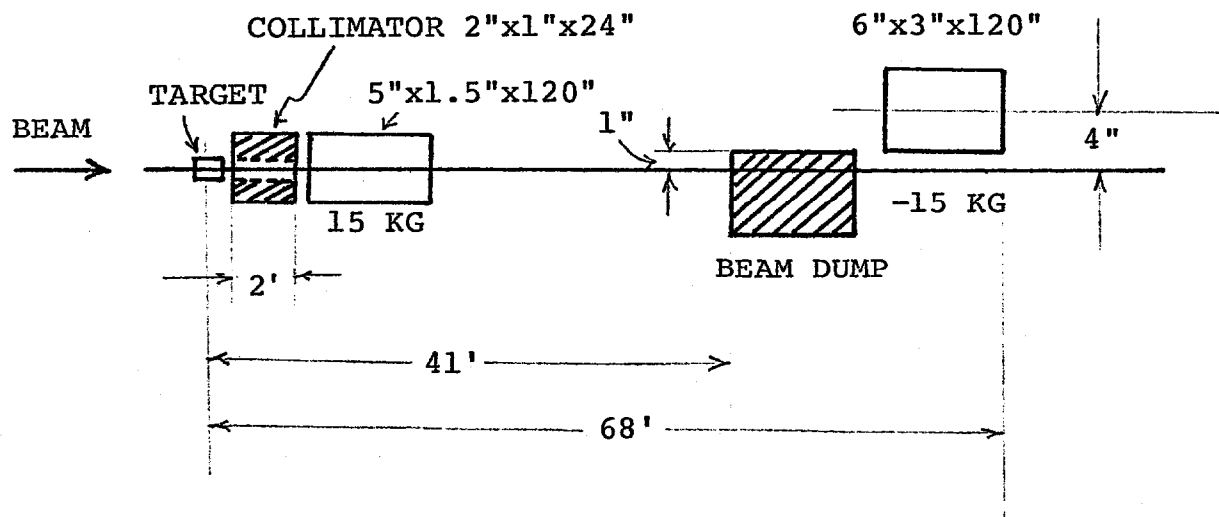
Figure 1(a) Schematic layout for the Sign Selected Bare Target Train

(b) Schematic layout for the electron neutrino beam

Figure 2 Electron neutrino or anti-neutrino flux from the K_L^0 decay and muon neutrino background from the π^+ and K^+ decays for the present electron neutrino beam. Also are shown muon anti-neutrino flux for the SSBT and anti-neutrino and muon neutrino flux for the Triplet Train configuration used in the run of December, 1976. Two muon anti-neutrino flux curves for the SSBT were computed by the Monte Carlo program and the NUADA program.

Figure 3 Electron neutrino fluxes from the K_L^0 decay for the incident proton energies of 400, 500 and 1000 GeV.

(A) SIGN SELECTED BARE TARGET



(B) ELECTRON NEUTRINO BEAM

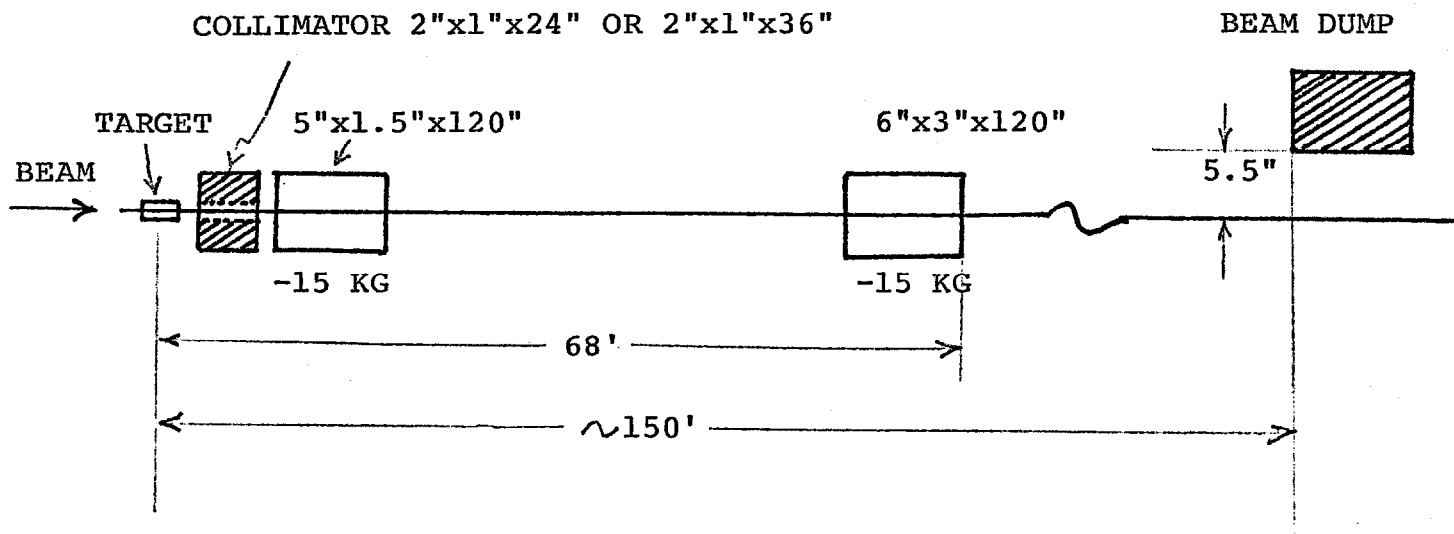
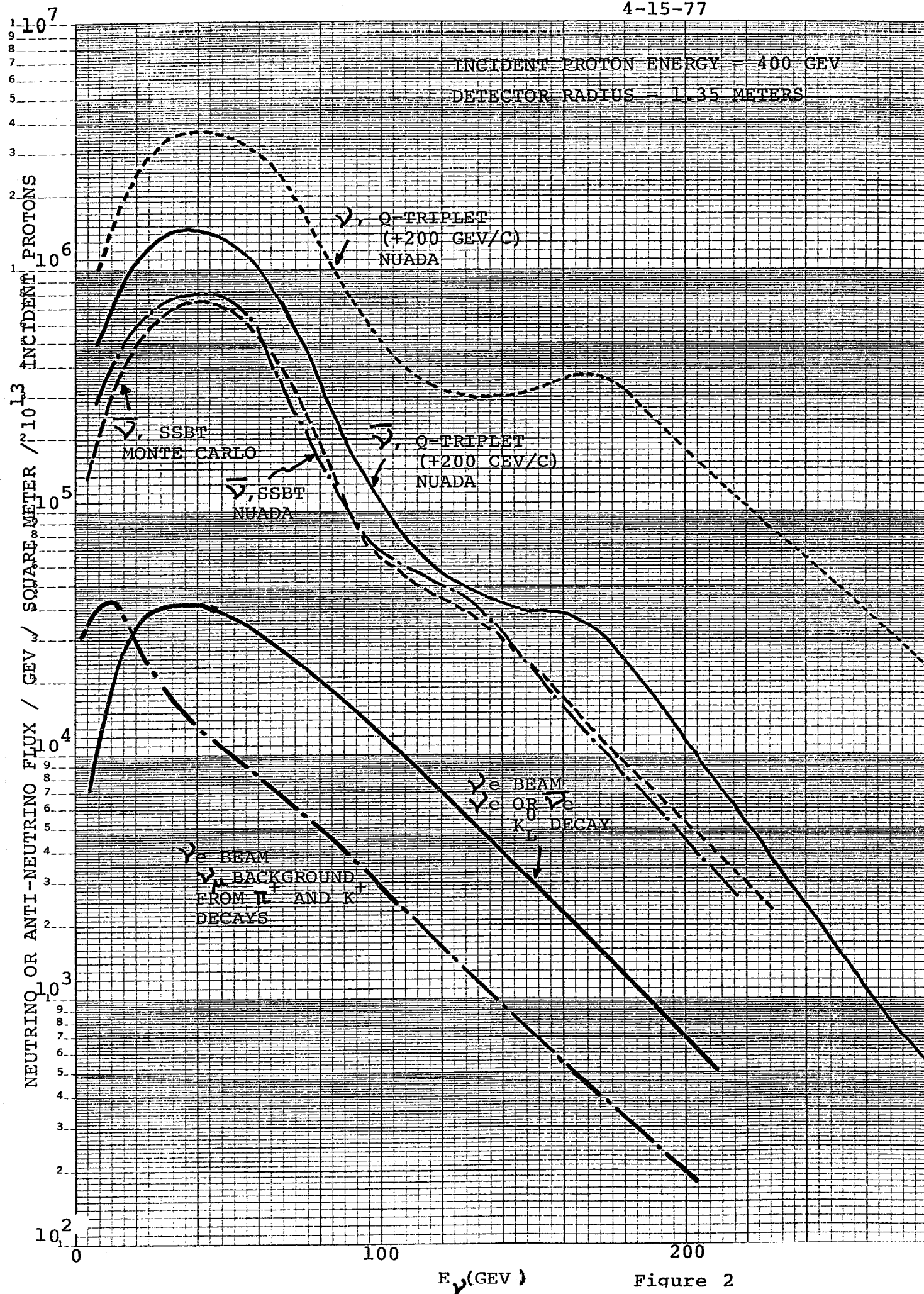


Figure 1.

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ELECTRON NEUTRINO BEAM FROM K_L^0 DECAY
DETECTOR RADIUS = 1.35 METERS

